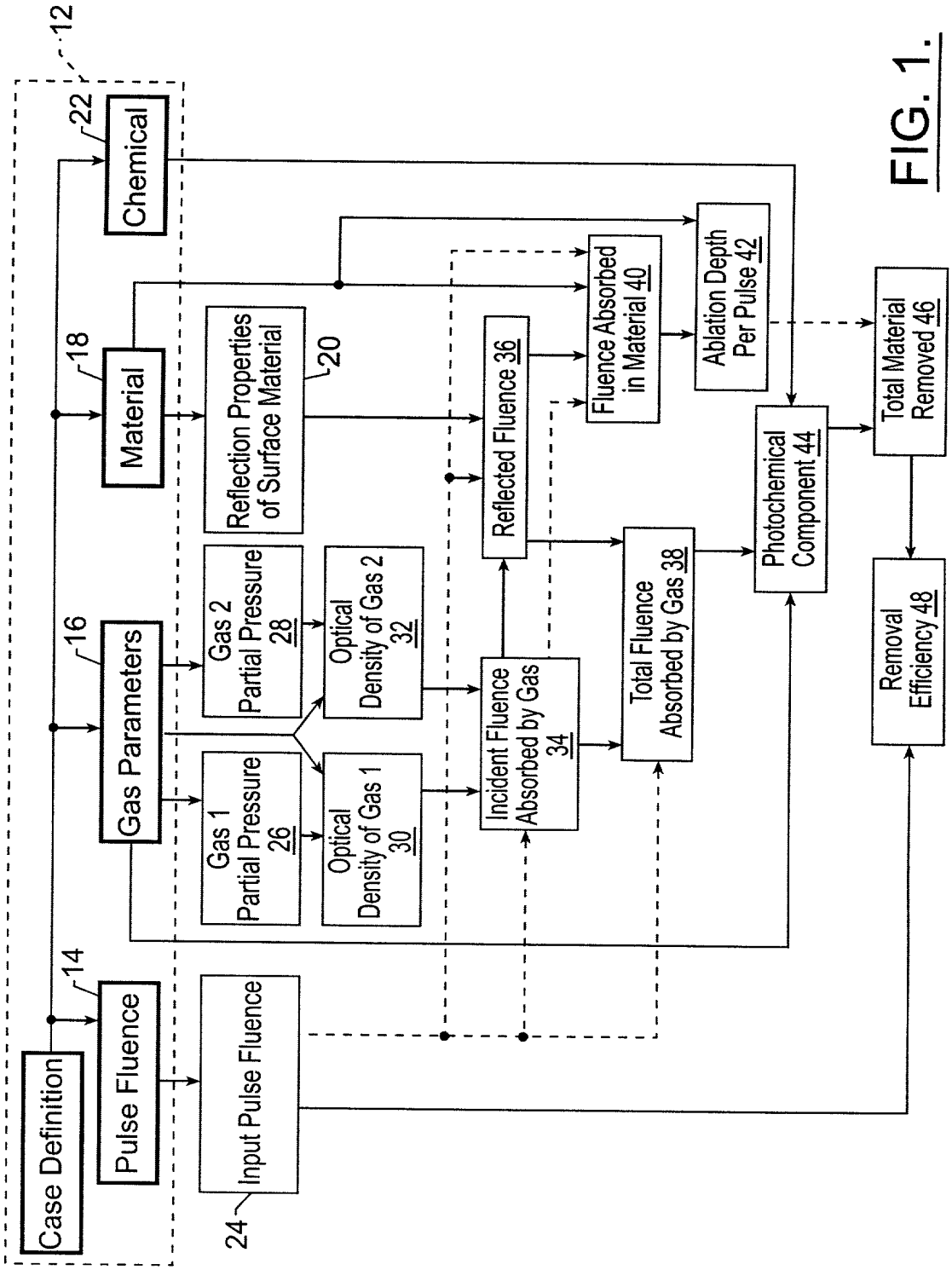
12
22
Chemical
18
Material
16
Gas Parameters
14
Pulse Fluence
Case Definition
24
Input Pulse Fluence
Reflection Properties of Surface Material
20
Gas 2 Partial Pressure 28
Gas 1 Partial Pressure 26
Optical Density of Gas 2 32
Optical Density of Gas 1 30
Incident Fluence Absorbed by Gas 34
Reflected Fluence 36
Fluence Absorbed in Material 40
Ablation Depth Per Pulse 42
Total Fluence Absorbed by Gas 38
Photochemical Component 44
Total Material Removed 46
Removal Efficiency 48

FIG. 1.

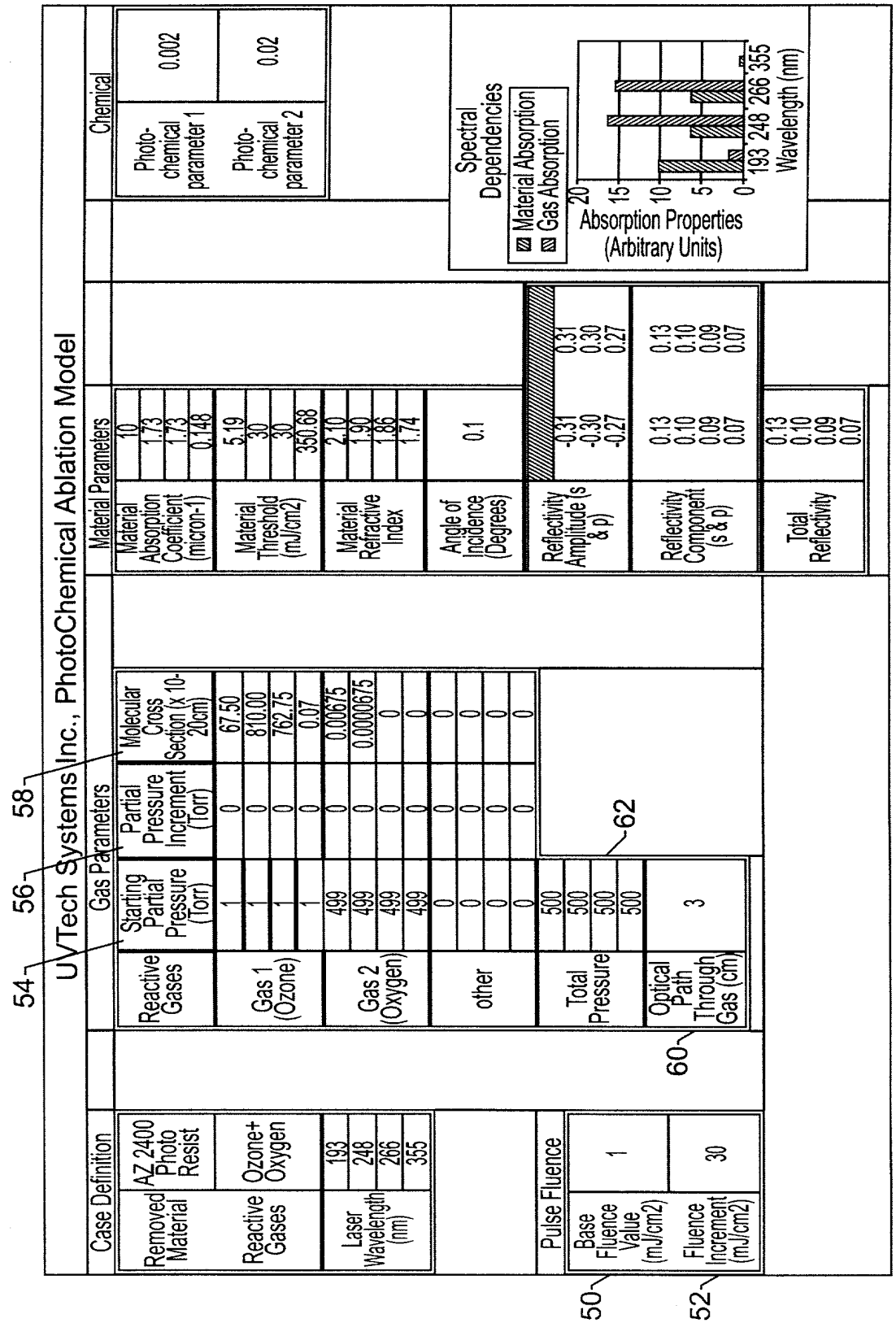
UVTech Systems Inc., PhotoChemical Ablation Model
Case Definition
Removed Material
AZ 2400 Photo Resist
Reactive Gases
Ozone+ Oxygen
Laser Wavelength (nm)
193
248
266
355
Pulse Fluence
Base Fluence Value (mJ/cm2)
1
Fluence Increment (mJ/cm2)
30
Gas Parameters
Reactive Gases
Starting Partial Pressure (Torr)
Partial Pressure Increment (Torr)
Molecular Cross Section (x 10-20cm)
Gas 1 (Ozone)
1
0
67.50
Gas 2 (Oxygen)
499
0
0.00675
other
0
0
0
Total Pressure
500
Optical Path Through Gas (cm)
3
Material Parameters
Material Absorption Coefficient (micron-1)
10
1.73
1.73
0.148
Material Threshold (mJ/cm2)
5.19
30
30
350.68
Material Refractive Index
2.10
1.90
1.86
1.74
Angle of Incidence (Degrees)
0.1
Reflectivity Amplitude (s & p)
-0.31
-0.30
-0.27
0.31
0.30
0.27
Reflectivity Component (s & p)
0.13
0.10
0.09
0.07
Total Reflectivity
0.13
0.10
0.09
0.07
Chemical
Photo-chemical parameter 1
0.002
Photo-chemical parameter 2
0.02
Spectral Dependencies
Material Absorption
Gas Absorption
Absorption Properties (Arbitrary Units)
0
5
10
15
20
193
248
266
355
Wavelength (nm)
50
52
54
56
58
60
62

FIG. 2.

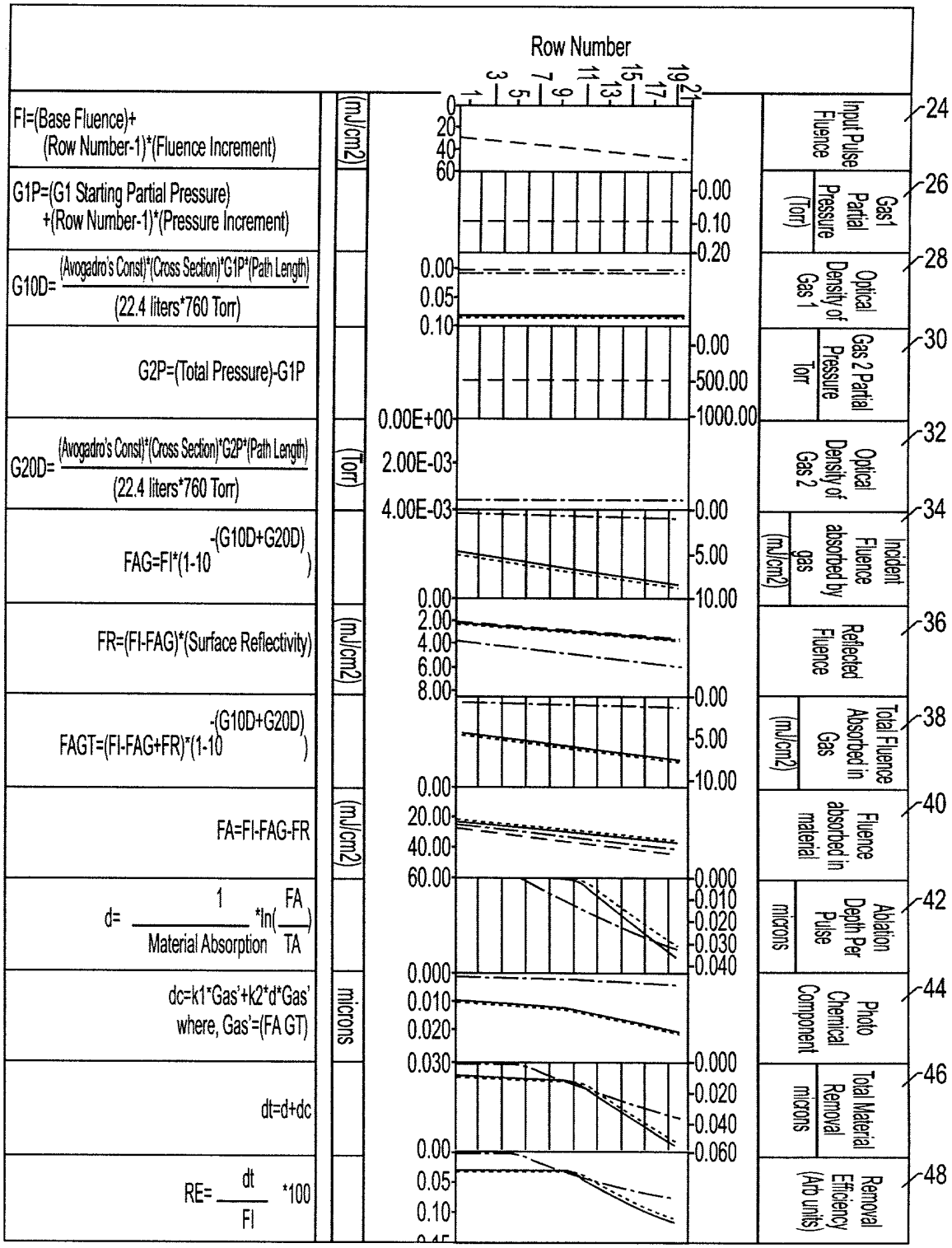
Row Number
1 3 5 7 9 11 13 15 17 19 21
FI=(Base Fluence)+ (Row Number-1)*(Fluence Increment)
G1P=(G1 Starting Partial Pressure) +(Row Number-1)*(Pressure Increment)
G10D= (Avogadro's Const)*(Cross Section)*G1P*(Path Length) / (22.4 liters*760 Torr)
G2P=(Total Pressure)-G1P
G20D= (Avogadro's Const)*(Cross Section)*G2P*(Path Length) / (22.4 liters*760 Torr)
FAG=FI*(1-10^-(G10D+G20D))
FR=(FI-FAG)*(Surface Reflectivity)
FAGT=(FI-FAG+FR)*(1-10^-(G10D+G20D))
FA=FI-FAG-FR
d= 1/Material Absorption *ln(FA/TA)
dc=k1*Gas'+k2*d*Gas' where, Gas'=(FA GT)
dt=d+dc
RE= dt/FI *100
(mJ/cm2)
(Torr)
(mJ/cm2)
(mJ/cm2)
(mJ/cm2)
microns
0 20 40 60
0.00 0.05 0.10
0.00E+00 2.00E-03 4.00E-03
0.00 2.00 4.00 6.00 8.00
0.00 20.00 40.00 60.00
0.000 0.010 0.020 0.030
0.00 0.10 0.20
0.00 500.00 1000.00
0.00 5.00 10.00
0.00 5.00 10.00
0.000 0.010 0.020 0.030 0.040
0.000 0.020 0.040 0.060
Input Pulse Fluence
Gas1 Partial Pressure (Torr)
Optical Density of Gas 1
Gas 2 Partial Pressure Torr
Optical Density of Gas 2
Incident Fluence absorbed by gas (mJ/cm2)
Reflected Fluence
Total Fluence Absorbed in Gas (mJ/cm2)
Fluence absorbed in material
Ablation Depth Per Pulse microns
Photo Chemical Component
Total Material Removal microns
Removal Efficiency (Arb units)
24
26
28
30
32
34
36
38
40
42
44
46
48

FIG. 3.

	24	26	28	30	32	34	36	38	40	42	44	46	48
193 nm													
	(mJ/cm2)	(Torr)		(Torr)		(mJ/cm2)	(mJ/cm2)	(mJ/cm2)	(mJ/cm2)	microns	microns	microns	
Row Number	Input Pulse Fluence	Gas1 Partial Pressure	Optical Density of Gas 1	Gas 2 Partial Pressure	Optical Density of Gas 2	Incident Fluence absorbed by gas	Reflected Fluence	Total Fluence Absorbed in Gas	Fluence absorbed in material	Ablation Depth Per Pulse	Photo Chemical Component	Total Material Removal	Removal Efficiency (arbitrary Units)
20	571	1.00	0.07	499.00	0.003573226	90.78	60.65	85.99	419.57	0.439	0.927	1.367	0.24
19	541	1.00	0.07	499.00	0.003573226	86.01	57.46	81.47	397.53	0.434	0.870	1.304	0.24
18	511	1.00	0.07	499.00	0.003573226	81.24	54.28	76.95	375.48	0.428	0.813	1.241	0.24
17	481	1.00	0.07	499.00	0.003573226	76.47	51.09	72.44	353.44	0.422	0.756	1.178	0.25
16	451	1.00	0.07	499.00	0.003573226	71.70	47.91	67.92	331.39	0.416	0.700	1.116	0.25
15	421	1.00	0.07	499.00	0.003573226	66.93	44.72	63.40	309.35	0.409	0.645	1.054	0.25
14	391	1.00	0.07	499.00	0.003573226	62.16	41.53	58.88	287.31	0.401	0.590	0.992	0.25
13	361	1.00	0.07	499.00	0.003573226	57.39	38.35	54.36	265.26	0.393	0.536	0.930	0.26
12	331	1.00	0.07	499.00	0.003573226	52.62	35.16	49.85	243.22	0.385	0.483	0.868	0.26
11	301	1.00	0.07	499.00	0.003573226	47.85	31.97	45.33	221.17	0.375	0.431	0.806	0.27
10	271	1.00	0.07	499.00	0.003573226	43.08	28.79	40.81	199.13	0.365	0.379	0.744	0.27
9	241	1.00	0.07	499.00	0.003573226	38.31	25.60	36.29	177.09	0.353	0.329	0.682	0.28
8	211	1.00	0.07	499.00	0.003573226	33.55	22.41	31.78	155.04	0.340	0.279	0.619	0.29
7	181	1.00	0.07	499.00	0.003573226	28.78	19.23	27.26	133.00	0.324	0.231	0.556	0.31
6	151	1.00	0.07	499.00	0.003573226	24.01	16.04	22.74	110.95	0.306	0.185	0.491	0.33
5	121	1.00	0.07	499.00	0.003573226	19.24	12.85	18.22	88.91	0.284	0.140	0.424	0.35
4	91	1.00	0.07	499.00	0.003573226	14.47	9.67	13.70	66.87	0.256	0.097	0.353	0.39
3	61	1.00	0.07	499.00	0.003573226	9.70	6.48	9.19	44.82	0.216	0.058	0.274	0.45
2	31	1.00	0.07	499.00	0.003573226	4.93	3.29	4.67	22.78	0.148	0.023	0.171	0.55
1	1	1.00	0.07	499.00	0.003573226	0.16	0.11	0.15	0.73	0.000	0.000	0.000	0.03

FIG. 4.